

Zero Retries issue 0182 2024-12-13

Zero Retries is an independent newsletter promoting technological innovation that is occurring in Amateur Radio, and Amateur Radio as (literally) a license to experiment with and learn about radio technology. Radios are computers - with antennas! Now in its fourth year of publication, with 2300+ subscribers.

About Zero Retries

Steve Stroh N8GNJ, Editor

Jack Stroh, Late Night Assistant Editor Emeritus

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Web version of this issue - <https://www.zeroretries.org/p/zero-retries-0182>

Request To Send

Commentary by Editor Steve Stroh N8GNJ

[Store and Forward Episode 9 — SuperPeater](#)

My co-conspirator Kay Savetz K6KJN and I just released our latest episode of Store and Forward - a podcast about the past and future of ham radio.

Kay reports that Internet Archive's security issues are almost entirely behind it - whew! Kay also discussed two new brand new collections within DLARC - a (broadcast) radio show about Amateur Radio in Japan, and a collection of Amateur Radio newsletters from Russia - with a dedicated American offering English synopses of each issue. Both are very cool, unexpected, and demonstrate the worldwide nature of Amateur Radio and the work that Kay is doing to represent the Amateur Radio activities of every country in DLARC.

I spent my portion of Store and Forward riffing on a concept about future data repeater systems has morphed in my mind to a new concept that I'm calling *SuperPeater*. Listen for more details on the podcast, and the second article in this issue of Zero Retries.

Zero Retries Brief Holiday Hiatus

Watching me struggle to explain the concepts of SuperPeater in this issue of Zero Retries over the past several days (*many* hours of butt-in-chair time with the laptop), my loving wife Tina urged me to do *one* more issue of Zero Retries for 2024, and then take two weeks off from publishing Zero Retries for the Christmas / New Years holiday period.

Trying to publish Zero Retries in advance and queue for later publication just hasn't worked out, to date, for me (it's double the workload / time commitment).

Thus, here is the Zero Retries schedule for the next four weeks:

- Zero Retries 0183 (the Christmas issue) will publish on 2024-12-20
- **No new Zero Retries issue on 2024-12-27**
- **No new Zero Retries issue on 2025-01-03**
- Zero Retries 0184 will publish on 2025-01-10

I *hope* that Zero Retries 0184 will be published on the Ghost email newsletter platform rather than Substack... but at the moment, that's TBD. As previously discussed, *that's the goal*, but realistically I only have so much energy and time for Zero Retries. Given the holiday downtime, I may not make my self-assigned goal of moving Zero Retries to Ghost "first thing" in 2025. My determination to move Zero Retries from Substack to Ghost hasn't changed; the move to Ghost *will* happen, it's just a matter of *when* it will happen. Doing so was a *goal* in 2024; in 2025 doing so is a *priority*.

Graphics - I Pity (Human) Professional Logo Designers

The (very preliminary) SuperPeater logo at the top of the SuperPeater story in today's issue required all of three minutes for the free version of OpenAI's ChatGPT / DALL-E systems to create. It took three iterations, each taking about 20 seconds. I only offered a vague description and my first attempt referenced a logo that's copyrighted or trademarked and ChatGPT said in essence "Sorry Steve, I'm afraid I can't do that". That was easily worked around by my stating not to infringe on any copyright or trademark.

While this version wasn't exactly what I envisioned... it was close enough, it was fast, and it was free. The last time I had to work with a professional (human) logo designer, it was a frustrating weeks-long back and forth, with ultimately nothing to show for it that would have justified the \$250 or so fee that the designer required for the full resolution image... that I wasn't really happy with.

This... experience was amazing. We live in interesting times.

Have a great weekend, all of you co-conspirators in Zero Retries Interesting Amateur Radio activities!

Steve N8GNJ

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What's New at DLARC — December 2024

By Kay Savetz K6KJN
Program Manager, Special Collections
Internet Archive, Digital Library of Amateur Radio & Communications
(and Zero Retries Pseudostaffer)

Greetings and happy holidays from DLARC, your free online ham radio library that is a project of the Internet Archive. Internet Archive is a non-profit library, and we're running our big end-of-year fundraiser. If you [make a donation using this special link](#), the fundraising folks will know that you're contributing with DLARC in mind. Your donation will help pay for staff and keep the petabytes of servers humming.

I was just running the numbers for the year, and was thrilled to see that through the end of November 2024, DLARC scanned 1,123,546 pages of material! That's 1.1 million pages of radio manuals, journals and magazines, newsletters, books, and catalogs. All of it is [online and full-text searchable](#). (That's only counting paper scans — we also digitized hundreds of video and audio tapes.) It's been a productive year.

I learned from [Amateur Radio Daily](#) about a Japanese radio show with the (mildly confusing?) name of [Ham's Radio](#). Ham's Radio is a program broadcast from Radio Narita near Tokyo. It's been going weekly since 2013, featuring news and interviews about the world of amateur radio from a Japanese perspective. Recent episodes have covered DMR radios, direction finding, Japanese ham festivals, and the poetic topic "Long Autumn Nights on 6m."

I reached out the producer Kei (pronounced just like my name) Yoshihara (JA1WTO) who gladly gave permission to add the program to DLARC. Which I did: 623 episodes are archived for your listening pleasure. A backup is great, but DLARC likes to add extra value whenever possible, so I added full transcripts of every episode. And since the show notes are written in Japanese, I used machine translation to add English versions of the show notes. I hope this will help researchers and hobbyists who don't speak Japanese find some of the incredible material Ham's Radio has broadcast over the past 11 years.

One of the many great things that we've been processing from the estate of Bob Cooper are many issues of [VHF-UHF Digest](#), the newsletter of the Worldwide TV-FM DX Association. The WTFDA is a club devoted to TV and FM DXing, DX 30-50 MHz utilities, and weather radio. Last year the

group provided DLARC with a pretty complete collection of newsletter scans going back to 1968 — we added those in April of 2023. But some of their scans were...kind of rough. Low resolution, or black and white, or hard to read, just not optimal. So when I found stacks of the paper newsletters in Coop's collection, I jumped at the chance to make better scans of the material, and now, [here they are](#).

Speaking of Coop, I'm continuing to add all sorts of material to the [Bob Cooper collection](#). Here's a pile of [radio commercials that aired in New Zealand](#) around 2010. Here's Cooper's memoir, [Television's Pirates: Hiding Behind Your Picture Tube](#) — and I just found a [pre-release version of the book](#) (with a slightly different name) which apparently he sent out to 500 people on floppy disk. New videos from Bob's extensive archive include a 1980 conference talk titled [How Legal is What You Are Doing?](#) and a quirky, low-budget 1980 TV show called [Pirate This Program](#). He definitely knew how to give things interesting titles to draw interest. (I still have more to sort through from Coop's stash.)

In newsletter news: we've added 221 issues of the [Antique Wireless Association of Southern Africa's ZS0AWA Newsletter](#). The AWASA is a radio club that's more than 20 years old, with a mission to facilitate, generate and maintain an interest in the location, acquisition, repair and use of yesterday's radios. In these pages you'll find repair and upgrade information, personal anecdotes, classic radio advertisements, and often, crossword puzzles that might make you question your technical chops. The FCC should use one of these crosswords as part of the Extra class exam. Or better yet, not. I never would have passed.

Without really planning it, we recently ended up with new collections from two ham radio groups in the Philadelphia Pennsylvania area. The [Penn Amateur Radio Club archive](#) is a collection of material from the University of Pennsylvania Amateur Radio Club, which dates back to 1909. The collection includes photos, certificates, QSL cards, and a very fun [home movie of Penn Amateur Radio Club activities](#) shot in The 1960s.

Then, there's the Holmesburg Amateur Radio Club, also in Philadelphia. This club, founded in 1977, is a baby relative to Penn, but still we have [147 issues of their "HARC Spark" newsletter](#), going back to 1982. Some are from their web site, others were scanned by us and are online for the first time.

From North Carolina we've added 172 issues of SWARC News, the newsletter of the [South Wake Amateur Radio Club](#); and from California's Bay Area, 249 issues of the [Marin Amateur Radio Society QSA-5 Newsletter](#) going back to the year 2000.

Finally: one of the first things that I did when I started work on DLARC in October 2022 was go to the major radio manufacturers' web sites and get a copy of every manual, firmware, and anything else that made sense to make a backup of. It's been a couple of years, so this month I went back to Yaesu to see what was new. I found about 250 new items for the [Yaesu library](#), including catalogs, videos, radio firmware and manuals. Just a backup, just in case.

73s until next year, when I'll get to talk about my favorite holiday, public domain day.

Digital Library of Amateur Radio & Communications is funded by a grant from Amateur Radio Digital Communications ([ARDC](#)) to create a free digital library for the radio community, researchers, educators, and students. If you have questions about the project or material to contribute, contact me at kay@archive.org.

DLARC want list: <https://archive.org/details/dlarc-wantlist>

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Very Preliminary SuperPeater Logo - generated by ChatGPT / DALL-E. Copyright (I guess) Steven K. Stroh (since it was my prompts that initiated it).

Explaining the Use Case for Data Over Repeater - Part 3

By Steve Stroh N8GNJ

*Continuation of a series begun in **Zero Retries 0179** -
Explaining the Use Case for Data Over Repeater - Part 1
and **Zero Retries 0181** -
Explaining the Use Case for Data Over Repeater - Part 2.*

Build The Data Repeater You Really Want

I was once told by a very experienced, very techie Amateur Radio Operator that his Amateur Radio club planned to construct a fast data repeater - I don't remember if it was a WA4DSY 56k data repeater, or a 9600 bps bit regenerative data repeater.

But that repeater would take time and effort, and as a stopgap that could easily be put up quickly and inexpensively, the club put up a slower, more basic

data repeater.

By the time the club was ready to consider constructing the fast data repeater, there was so much usage of the slower, more basic data repeater that there was little enthusiasm for the fast data repeater.

When he told this story to me and a few others that were interested in fast data repeaters, he said the moral of that story was “build the fast data repeater from the beginning, even if it takes longer. You’ll only get one chance to build a user community, and once they’ve committed to building their station to work with the data repeater, you won’t get many of them to rebuild their station for a different technology”.

Remembering that story was one of the subtle influences of my idea for a SuperPeater.

...

A vague idea about a data repeater that is capable of multiple data modes, using multiple input channels, only coalesced in my mind after completing Part 2 in the past week into a concept I started calling a Data SuperPeater, but now shortened to just **SuperPeater**. My concept was heavily influenced by the work done on several Amateur Radio PACSAT satellites beginning in the 1980s. I verbally explained the basics of SuperPeater in [Store & Forward Episode 9](#). From the show notes:

In an article Steve wrote for the Internet Archive blog:

<https://blog.archive.org/2024/07/10/using-dlarc-amateur-radio-operators-are-resurrecting-technical-ideas-from-the-past-using-21st-century-tech/> ... he mentioned one interesting project from past decades called a PACSAT (Packet Satellite). PACSAT’s can be thought of as “Flying Bulletin Board Systems” where a message or bulletin can be uploaded to a PACSAT in one part of its orbit, and downloaded on another part of its orbit. Several PACSATs were flown, and they worked pretty well.

The key concept that unlike a typical Amateur Radio repeater (including data repeaters), a PACSAT featured multiple uplink channels and in the case of multiple simultaneous transmissions received on multiple inputs, a queuing system was used. There were many other innovative features of the PACSATs, including robust modulation methods.

The connection between DLARC and Zero Retries is that all the archival information about PACSATs is in DLARC:

<https://archive.org/details/dlarc?tab=collection&query=packsat>

- 11 formal research / presentation papers presented at the Digital Communication Conferences
- 9 newsletter articles in the TAPR Packet Status Register newsletter
- Even a book – The PACSAT Beginner’s Guide

What’s amazing to consider about PACSAT technology in the 2020s is that the PACSAT developers and engineers *solved all the hard parts*, and made it work, and proved it all out by flying multiple PACSATs. But, back then, they had to invent the technology, build custom hardware, build custom software, invent new algorithms and access protocols, etc.

Now, *all of that technology is easy, inexpensive, and off the shelf* – mostly software running on existing hardware:

- Different modulation techniques that were tough in 1983, not so much now
- Multiple uplink channels, again tough in 1983, not so much now (ka9q-radio)
- Multiple inputs received – queuing (we have lots of RAM to buffer multiple inputs received simultaneously; 8 GB on a Raspberry Pi 5)
- Dedicated fast computers such as Raspberry Pi for running the dedicated digital processing software
- Multitasking operating systems (including, recently, realtime versions of Linux)
- And, in general, Software Defined Radios hardware

Thus, imagine a terrestrial “SuperPeater” data repeater with its output on 222-225 MHz that transmits at perhaps as fast as 38400 bps in a standard repeater channel. Receiving that data stream can be received with an inexpensive Software Defined Receiver and modem software. There could be multiple input channels to the SuperPeater including on 144-148 MHz and 440-450 MHz, with various data speeds / modem types on multiple channels. The SuperPeater can queue what it receives on each channel and output it all, queued, on the high speed output channel.

As Steve envisions a SuperPeater, it’s mostly a “simple matter of software” 😊

Admittedly, that last line is a bit glib... but “big hand waving” conceptually, I think that’s true. Most of the “heavy lifting”, signal processing, waveform generation, protocols, networking, etc. in a SuperPeater would (again, conceptually) be done in software.

A second primary formative influence on the SuperPeater concept is that one of the amazing technology advances for Amateur Radio in the 2020s is the development of inexpensive and highly capable *Software Defined Receivers*. These devices completely change the paradigm of repeaters, making a SuperPeater possible. For example, for a user to receive a wide bandwidth transmission / high speed transmission on 222-225 MHz is hard and expensive. There is only one user radio currently in production with a (no modifications required) flat audio connection - the [Bridgecom Systems BCM-220](#). It’s similarly hard to find a 50-54 MHz radio currently in production with a (no modifications required) flat audio connection. But for a Software Defined Receiver, such frequency ranges are “easy” and inexpensive (in comparison to buying a radio for those bands).

Thus a SuperPeater could be as “simple” as:

TX: Computer → Software Defined Transmitter → Power Amplifier → Antenna
RX: Antenna → Software Defined Receiver → Computer

(The Transmitter and Receiver could be the same unit if a high performance Software Defined Transceiver is used.)

Like conventional repeaters, there are several functional blocks to a SuperPeater:

- Duplexer / Feedline / Antenna
- Receiver(s)
- Transmitter
- Controller

I'm not an expert on repeaters, but there are many other details to any well-designed repeater system such as power supply / battery backup, receiver preamplifier, transmit power amplifier, links to other repeaters, lightning protection, High SWR protection (if the antenna is hit by lightning and becomes a bad SWR match to the transmitter), overall system monitoring (telemetry), backup (auxiliary) repeater in case of major failure, etc. For purposes of discussion of SuperPeater, I'll be focusing only on the four functional blocks specifically listed.

SuperPeater Primary Concept - Cross Band Transmitter / Receiver(s)

Single-band¹ repeaters are most common in Amateur Radio because surplus VHF / UHF repeaters and commercial radios were inexpensive decades ago. Thus "radios to match" (single-band) radios² were initially surplus single-band commercial two way radios, and later purpose-built radios for Amateur Radio, matched the single-band available repeaters.

But in the 2020s and beyond, not only is a "single-band repeater" not necessary, there are significant advantages for a data repeater to operate on multiple Amateur Radio VHF / UHF bands.

The primary disadvantage of a single-band repeater is that an expensive and complex cavity duplexer is required³ to isolate the transmitter energy from the receiver into a single-band antenna. A cavity duplexer is tuned for one specific transmit frequency and one specific receiver frequency. Cavity duplexers that are "repeater grade" are expensive.

But in a cross band repeater, a cavity duplexer is not strictly necessary as the transmit frequency and receive frequency(ies) can be on different bands and thus widely separated, and the duplexer / antenna subsystem can be inexpensively implemented with a "triplexer"⁴ and a [tri-band antenna](#).

Thus the cost reduction of a cross band repeater (no cavity duplexer) makes it more feasible to deploy a cross band repeater than a single-band repeater. Perhaps even feasible enough to deploy at individual Amateur Radio Operator's homes⁵.

Another factor favoring cross band repeaters versus single-band repeaters is that the single-band frequency pairs for repeaters are heavily managed by repeater coordination groups. Thus if a cross band repeater is using only a single transmit frequency in a specific band and not using one of the conventional (managed) repeater pairs, it seems to me that such usage is outside the purview of repeater coordination groups.

SuperPeater Primary Concept - Wide Bandwidth / High Speed Transmission System

As explained earlier, there are *already* a wide variety of Wide Bandwidth / High Speed Data Repeater Systems that are well-proven:

- Microwave networking such as AREDN - potentially 10s of Mbps.
- New Packet Radio (up to 1 Mbps)
- Icom D-Star Digital Data (DD) mode (128 kbps)
- WA4DSY 56KB RF Modem
- 9600 bps bit regenerative repeaters

Add to those...

- Wi-Fi chipsets operating with 5 MHz channels transverted down to 1.24-1.30 GHz or 420-450 MHz
- Amateur Radio Digital Video (1 or 2 MHz channels)
- MMDVM-TNC (up to 38400 bps)
- VARA FM (up to 25 kbps)
- M17 data mode (9600 bps)
- Many others that I'm sure exist(ed), that I've forgotten

It might seem unrealistic to imagine a SuperPeater having such flexibility for modes / bandwidths, etc. but that's really not the case. For the single transmitter that would be needed, high performance Software Defined Transmitters, Receivers, or Transceivers are available such as the [Ettus Research USRP Embedded Series](#)⁶ are available off the shelf and are very widely supported within GNU Radio. For "hardened" applications like very remote repeater sites, there are also equivalent units intended for satellite use (where's there's *no* possibility of service or replacement).

While it's admittedly simpler to choose a single Wide Bandwidth / High Speed Transmission System for a SuperPeater, it's feasible to switch modes periodically... or even dynamically interleave multiple modes depending on the particulars of the data being transmitted. The fast, flexible computer and software used for the user stations allows such choices by (one example) running multiple Demodulators and Protocol Decoders in parallel so when the SuperPeater switches modes, the user receivers have no trouble decoding multiple modulation methods and multiple protocols.

SuperPeater Primary Concept - Software Defined Receiver(s) Running ka9q-radio

Another significant differentiation of a SuperPeater versus a conventional repeater is that its receiver system has *multiple receive channels* - perhaps *many* receive channels. This is a concept inspired by the PACSATS - multiple low speed uplinks and a single high speed downlink.

A SuperPeater receiver consisting of multiple, multi-band, multi-mode input channels is made possible by combining a Software Defined Receiver and [ka9q-radio software](#).

In a SuperPeater, each input channel is on a band that's different than the SuperPeater transmitter. In the earlier example, if a SuperPeater transmitter operates on 222-225 MHz, a SuperPeater's receiver would be on the 144-148 MHz band or the 420-450 MHz band, or perhaps even on the 50-54 MHz or the 1.24-1.30 GHz bands. Again, this separation of the transmit and receiver(s) into different bands is to promote flexibility, experimentation, and lower cost by not (necessarily) requiring a cavity duplexer for single-band operation.

In conjunction with a Software Defined Receiver, ka9q-radio creates a multiple channel receiver. Phil Karn KA9Q, the creator ka9q-radio, has stated that at his home station in San Diego, California, he receives *all* repeater output channels on 144-148 MHz, 222-225 MHz, and 440-450 MHz *simultaneously* (not sequentially scanned). Simultaneous receiving of all input channels is critical for the SuperPeater concept as if scanning of multiple input frequencies was used, data transmitted by users could be lost in the scanning interval of a specific channel. Dedicated receivers could also be used, but that adds complexity... and there's simply no need in this era with Software Defined Receivers and now ka9q-radio.

With current Software Defined Receiver technology, each band to be received requires a separate Software Defined Receiver unit⁷, but if a tri-band antenna and triplexer is used for the SuperPeater, again using the example of a SuperPeater transmitting on 222-225 MHz, a Software Defined Receiver is connected to the 144-148 MHz triplexer port, and another is connected to the 440-450 MHz triplexer port. Then ka9q-radio is configured to receive the specific input channels and modes, which are connected to the repeater controller.

The primary idea behind a SuperPeater's multiple receive channels is to make it easy and inexpensive for Amateur Radio Operators to access the SuperPeater with whatever radio / modem system they can afford. High speed data radios (transmitters) for individuals can get expensive and complex, thus a SuperPeater can accommodate a number of lower speed users with frequency diversity and dedicated channels for different modes⁸.

A secondary reason for a SuperPeater to use multiple receive channels is remote receivers / diversity that is already widely in use by large repeater systems / networks. Simply, put multiple receivers in geographically diverse areas so that users can more easily transmit a good signal into the repeater.

With ka9q-radio, *there can be as many receiver inputs as needed*. Here are just some examples of (ka9q-radio) "virtual" receivers for a SuperPeater:

- 9600 bps AX.25 on 144-148 MHz or 440-450 MHz such as used by the Kenwood TM-D710A/GA radio,
- 19200 bps on 144-148 MHz or 440-450 MHz with IL2P Forward Error Correction such as used in MMDVM-TNC and NinoTNC using a radio with a flat audio connection,
- M17 digital voice / data on 440 MHz,
- 1 Mbps⁹ New Packet Radio on 440 MHz.
- New modes not yet invented can be assigned to just another virtual receiver channel in ka9q-radio.

The use case of these different modes and receiver channels is explained in the following sections.

Primary Concept - User Station Software Defined Receiver

We've had advanced data repeaters for decades such as repeaters built for the [WA4DSY 56KB RF Modem](#), 9600 bps bit regenerative repeaters such were built for the [Puget Sound Amateur Radio TCP/IP Network](#), [New Packet Radio](#) (has a repeater mode, operates at speeds up to 1 Mbps), and [Icom D-Star Digital Data \(DD\)](#) repeaters (operates at 128 kbps).

While it's feasible to commit a large budget and significant resources to developing a single advanced data repeater...

The problem with advanced data repeaters has always been the cost and complexity of **user stations** to communicate with advanced data repeaters.

The reason for a SuperPeater to use a wide bandwidth / high speed transmission system is that a wide variety of data types can be multiplexed into a single data stream if that data stream is fast enough (high speed) and flexible for various data types - similar to the way the Internet accommodates a wide variety of data types.

Receiving a wide bandwidth / high speed signal transmitted from a SuperPeater, ~~is problematic~~ *used to be problematic*. What's different in the 2020s is that we now have inexpensive, highly capable Software Defined Receivers that can be the receive section of a SuperPeater user station.

Thus another key concept of the SuperPeater concept is in a user station, decoupling the receive function from the transmit function. The receiver and the transmitter no longer need to be in the same radio, the same box, the same band) and use an inexpensive, well-supported Software Defined Receiver to receive the SuperPeater's wide bandwidth / high speed transmissions.

For example, a [RTL-SDR RTL2832U V4](#) can receive all of the Amateur Radio VHF / UHF bands (up to 1.766 GHz) and receive a bandwidth up to 2.56 MHz. I specified this unit because it is the least expensive (for a known to be high quality unit) and most widely supported in software for all platforms. Thus if a SuperPeater transmits within the 222-255 MHz band, a SuperPeater *user's receiver* can be an inexpensive combination of a Software Defined Receiver, a Raspberry Pi 4 or Raspberry Pi 5, connected to the 222-225 MHz port of the user's triplexer / tri-band antenna.

Whatever modulation, bandwidth, data speed, etc. transmitted by the SuperPeater can be received and demodulated / decoded by such a receiver... again easily and inexpensively - it's only a "simple matter of software" which could easily be (*vastly* simplified for easier explanation) a series of modules (blocks) running within [GNU Radio](#) on Linux on a Raspberry Pi:

222-225 MHz Receiver → Demodulator → Protocol Decoder → User Interface / Network

When the SuperPeater's transmission system is upgraded / improved, the user station receivers can easily be upgraded at the same time with a new software load for their receivers, downloaded from a server on the Internet... or more appropriately, transmitted by the SuperPeater *in advance of the change* using a "broadcast file protocol" such as [flidigi flamp](#).

Nearly any new transmission system can be accommodated by the SuperPeater users as long as the bandwidth of the SuperPeater's transmission system is no larger (in the case of the RTL-SDR RTL2832U V4) than 2.56 MHz.

Primary Concept - User Station Transmitter - Best Available Speed

Again, the problem with advanced data repeaters has always been *the cost and complexity of user stations* to communicate with advanced data repeaters.

With the receiver decoupled from the transmitter in a SuperPeater user station, and the availability of multiple SuperPeater input channels that can be segmented by speed / mode, then any number of "best available speed" types of data transmitters can be used to transmit to a SuperPeater that are reasonably fast, reasonably available, and affordable. For example these (potentially) commonly available systems:

- 64000 bps New Packet Radio on 440 MHz,
- 19200 bps on 144-148 MHz or 440-450 MHz with IL2P Forward Error Correction such as used in MMDVM-TNC and NinoTNC using a radio with a flat audio connection,
- 9600 bps AX.25 on 144-148 MHz or 440-450 MHz such as used by the Kenwood TM-D710A/GA radio,
- 9600 bps M17 digital data on 440 MHz
- 3600 bps NinoTNC using a standard radio's microphone / speaker connections.

In my opinion, the best "bang for the buck" combination of data interface and data radio, for a user station *transmitter* to connect to a SuperPeater that is *currently* available off the shelf is:

- [RPC Electronics SMT TARPN NinoTNC](#)
- [Yaesu FTM-6000R](#) - see the **Zero Retries Guide to VHF / UHF Radios for Data**, No Modification Required / In Production / Amateur Radio section for details.

While the SMT TARPN NinoTNC has the advantage of being a simple "modem appliance", likely a more future-proof "modem" is an audio interface with modulations, etc. done in software on a host computer, and thus easily changed / updated, such as:

- [Masters Communications Model DRA-50M](#)

Again, at a minimum, each different mode of transmission to a SuperPeater will have a receiver channel assigned to that mode. Remember that a SuperPeater, using ka9q-radio, *all receiver channels are virtualized*, thus there can be as many as are needed.

For contention control, the "transmitter radio" can either listen for other transmissions (which it may, or may not hear because of the Hidden Transmitter / Node Problem). A second contention control mechanism is that the SuperPeater receiver can immediately detect that a particular input channel is in use, and transmit a "don't transmit now on channel X" flag in the data stream (excluding the current station, of course) and then stop transmitting that flag as soon as the transmission is complete.

This largely completes the concepts of the SuperPeater and the SuperPeater user stations. I will continue this discussion with the overall use case and user experience in Zero Retries 0184 or Zero Retries 0185 in 2025.

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ZR > BEACON

By Steve Stroh N8GNJ

Short mentions of Zero Retries Interesting items.

[VERO VR-N76 KISS Function Updated](#)

Email newsletter from VERO Telecom:

Dear VR-N76 Users,

After your positive feedback and nearly a month of hard work by our engineers, I am now excited to announce that the VR-N76's KISS function can now fully integrate via Bluetooth to virtually any supported application running on desktops, tablets, or other compatible devices. Whether you're integrating packet radio applications, APRS clients, or other digital communication tools, KISS mode ensures a straightforward, industry-standard interface.

Now turn on your radio, upgrade to the latest firmware, and enjoy it.

The new firmware of VR-N7500 including KISS function and 32 channels has been added to beta. If you are interested in testing, you can actively upgrade.

Feedback & Support

Maybe you will find some faults and imperfections during use. Welcome to send us emails for feedback. info@verotelecom.com

As I understand it, there is a software upgradeable TNC, or modem, integrated into the VR-N76 portable radios (you have a wide choice of *colors*). This

development means that you can access that TNC or modem over a Bluetooth connection, and it presents as a KISS interface.

Time didn't permit me to dig into the details - can the TNC / modem be changed for modulation, speed, etc.? No mention of apps that the company envisions can be used with the VR-N76 via KISS, but at a minimum, certainly basic packet radio, Winlink, APRS, etc.

On the face of it, *this is cool*. Just prop your VR-N76 on a table (or the closest window for best performance) and connect via Bluetooth from a laptop or mobile phone and fire up an app that has a KISS interface.

[Recommendations for Portable / Mobile 70cm / 23cm DVB-T \[Video\] Station](#)

Jim Andrews KH6HTV in ATV Journal 178:

I have often been asked - "What equipment should I buy if I want to get started in DATV, but I can't operate from my home base due to poor location to access the repeater?". This means one needs to be able to instead operate mobile, or set up a portable station out in the field somewhere. This thus also applies to ARES groups thinking about getting into adding ATV as part of their "bag of tricks" to offer to their local public safety agencies of police, fire, etc. So, I am offering here my suggestions of the key elements required to assemble just such a DATV station.

KH6HTV provides a *great* overview of his suggested components for such a system, along with pricing.

[Foundations of Amateur Radio - Bald Yak - Week 2](#)

Onno Benschop VK6FLAB on the FOAR Podcast:

During the week an interesting question was put to me. Am I going to make this into a GNU Radio tutorial? In short, no and yes. At this point I know enough about what I'm attempting, to recognize that I'll be deep diving into the bowels of GNU Radio and the inevitable idiosyncrasies that a large project like that has and as a result I'll likely have to explain the context in which something broke, which will no doubt result in me having to walk you through the details.

So, this means that there will be trips into how this thing works, but I'm not currently planning a GNU Radio course, not only because that's not what Bald Yak is about, but because I like to know what I'm talking about, even if the peanut gallery might at this point call out: "Why start now?" -- yes, from time to time, what I'm talking about here is based on something I'm still in the process of learning and obviously I make mistakes.

Now, if you haven't been playing along, let me state the purpose of why I'm here.

"The Bald Yak project aims to create a modular, bidirectional and distributed signal processing and control system that leverages GNU Radio."

In the pursuit of happiness, I've been resisting making a table with the various communication protocols in use to extract data and control the data stream within the software defined radio world. I've been avoiding this because I don't feel like I know the landscape well enough. Of course, making the table will create a better understanding, chicken and egg.

I do have a handle on what functionality is required. So, in the spirit of writing it down or it didn't happen, here's what I know.

I love this series about learning how to *use* GNU Radio, from no previous experience, with an Amateur Radio context. He's stumbling along, and documenting the process, much as I would be doing. I certainly can commiserate, having *my* share of "Bald Yaks" in my background.

[FCC Opens Entire 6 GHz Band To Very Low Power Device Operations](#)

FCC Media Release:

WASHINGTON, December 11, 2024—The Federal Communications Commission today adopted new rules to expand very low power device operations across all 1,200 megahertz of the 6 GHz band alongside other unlicensed and Wi-Fi-enabled devices. This added flexibility in the 6 GHz band will bolster a growing eco-system of cutting-edge applications like wearable technologies and augmented and virtual reality, which will enhance learning opportunities, improve healthcare outcomes, and bring new entertainment experiences. The FCC has, in recent years, expanded unlicensed use between 5.925 and 7.125 GHz, helping to usher in Wi-Fi 6E, set the stage for Wi-Fi 7, and support the growth of the Internet of Things.

The Report and Order permits the very low power (VLP) class of unlicensed devices to operate across 350 megahertz of spectrum in the U-NII-6 (6.425-6.525 GHz) and U-NII-8 (6.875-7.125 GHz) portions of the 6 GHz band at the same power levels and technical/operational protections as recently approved for the U-NII-5 (5.925-6.425 GHz) and U-NII-7 (6.525-6.875 GHz) bands while protecting incumbent licensed services that also operate in the band. These VLP devices will have no restriction on locations where they may operate and will not be required to operate under the control of an automatic frequency coordination system. To ensure the risk of interference remains insignificant, the devices will be required to employ a contention-based protocol and implement transmit power control while prohibited from operating as part of a fixed outdoor infrastructure.

VLP devices operate at very low power across short distances and provide very high connection speeds, which are ideal for the types of high-data rate cutting-edge applications that will both enrich consumer experiences and bolster the nation's economy. The FCC's actions in the 6 GHz band will spur innovation by providing more capacity for emerging technologies and applications, such as augmented reality and virtual reality, in-car connectivity, wearable on-body devices, healthcare monitoring, short-range mobile hotspots, high accuracy location and navigation, automation, and more.

For context, the 6 GHz band's primary allocation is for outdoor, long range licensed-by-link point to point microwave links. This new ruling allows secondary usage for indoor, very low power use, and notably does not require a non-interference mechanism to be used - just keep the transmit power and

antenna systems *very* low profile.

This is indeed a very big deal. While there was some usage of some of the 6 GHz band for “Wi-Fi” beginning with Wi-Fi 6E, this new availability of 1200 MHz of *contiguous* spectrum for low power (indoor) operations is a *momentous* development. This will probably require new Wi-Fi units to fully take advantage of this new spectrum, but for the first time such an investment will be substantially better capabilities, rather than incrementally better capabilities.

[Raspberry Pi 500 and Raspberry Pi Monitor Now Available](#)

Eben Upton on the Raspberry Pi blog:

Meet Raspberry Pi 500

In the four years since it launched, Raspberry Pi 400 has become a hugely popular choice for enthusiasts and educators. And today, we’re launching its successor, [Raspberry Pi 500](#), bringing the features and performance of the Raspberry Pi 5 platform to our all-in-one form factor:

- 2.4GHz quad-core 64-bit Arm Cortex-A76 processor
- 8GB LPDDR4X-4267 SDRAM
- VideoCore VII GPU, supporting OpenGL ES 3.1 and Vulkan 1.3
- Dual 4Kp60 HDMI® display output
- Dual-band 802.11ac Wi-Fi® and Bluetooth 5.0
- 2 × USB 3.0 ports, supporting simultaneous 5Gbps operation
- 1 × USB 2.0 port
- Gigabit Ethernet port
- Horizontal 40-pin Raspberry Pi GPIO connector

Raspberry Pi 500 is priced at \$90, including a 32GB Raspberry Pi-branded SD card, and is also available in a \$120 Desktop Kit, which adds:

- Raspberry Pi Mouse
- Raspberry Pi 27W USB-C Power Supply
- 2m micro HDMI to HDMI cable
- Raspberry Pi Beginner’s Guide, 5th Edition

Nothing revolutionary about either the Raspberry Pi 500 or the new Raspberry Pi Monitor, but *useful* as the RPi 500 is 3x the performance of the Raspberry Pi 400 for only \$10 more, and unlike the Raspberry Pi 5 (which requires a *noisy* fan), is silent as it has a large heatsink for the hot components and thus doesn’t require a fan.

I think there’s a opening for someone to design an adapter board for the horizontal GPIO header on the back of the RPi 500 to cleanly orient, connect, and display popular Amateur Radio Raspberry Pi HATs such as the new hardware options for DigiPi (discussed in previous issues of Zero Retries).

Jeff Geerling KF0MYB [reviewed the RPi 500](#) and does a teardown during which he discovers that there will likely be a successor to the RPi 500 (500+?) that will make use of the unpopulated area of the RPi 500 circuit board apparently intended for a M.2 slot. Current storage options for the RPi 500 are the usual MicroSD slot, or an external SSD connected via USB-3.

For the reasonable price and 3x the performance of the Raspberry Pi 400, I’ll be investing in a few RPi 500s. At this point they’re the easiest way to watch videos in a web browser connected to a large television display like in N8GNJ Labs.

Leave a comment

Share

Feedback Loop

The comments section for Zero Retries 0181 was lots of fun last week!

Lots of great followup discussions there!

Thank you Zero Retries readers and commenters!

Join the Fun on Amateur Radio

If you’re not yet licensed as an Amateur Radio Operator, and would like to join the fun by *literally having a license to experiment with radio technology*, check out

Join the Fun on Amateur Radio for some pointers.

Closing the Channel

In its mission to highlight technological innovation in Amateur Radio, promote Amateur Radio to techies as a literal license to experiment with radio technology, and make Amateur Radio more relevant to society in the 2020s and beyond, Zero Retries is published via email and web, and is available to everyone at no cost. Zero Retries is proud *not to participate* in the Amateur Radio Publishing Industrial Complex, which hides Amateur Radio content behind paywalls.

My ongoing *Thanks* to:

- Tina Stroh KD7WSF for, well, *everything*!
- **Annual Founding Members who generously support Zero Retries financially:**
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 - Founding Member 0007 - Merik Karman VK1DF / VK2MKZ (Renewed 2024 *with two Founding Member subscriptions*!)
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 - Founding Member 0011 - Rick Prelinger W6XBE (New 2024)
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- One particularly effective method of promoting Zero Retries is to add a mention of Zero Retries to your [QRZ](#) page (or other web presence) and include a link:

<https://www.zeroretires.org>
- If you'd like to financially support Zero Retries, becoming a paid subscriber is *greatly* appreciated and helps offset expenses incurred in publishing Zero Retries. Paid subscriptions for Zero Retries are *entirely optional*, as explained in this special issue of ZR:
Zero Retries Administrivia - Activating Payment Options.

These blogs and newsletters regularly feature Zero Retries Interesting content:

- [Dan Romanchik KB6NU](#) mentions “Zero Retries Interesting” topics so regularly on his blog (that I otherwise wouldn’t know about) that I’ve bestowed on him the honorific of Pseudostaffer.
- [Jeff Davis KE9V](#) also mentions “Zero Retries Interesting” topics so regularly on his blog (that I otherwise wouldn’t know about) that I’ve bestowed on him the honorific of Pseudostaffer.
- [Amateur Radio Weekly](#) by Cale Mooth K4HCK is a weekly anthology of links to interesting Amateur Radio stories that often feature “Zero Retires Interesting” topics.
- [Experimental Radio News](#) by Bennet Z. Kobb AK4AV discusses (in detail) Experimental (Part 5) licenses issued by the US FCC. It’s a *must-read-now* for me!
- [RTL-SDR Blog](#) - *Excellent* coverage of Software Defined Radio units.
- [TAPR Packet Status Register](#) has been published continuously since 1982.
- [Hot Iron - The Journal of the Constructor’s Club](#) is a delightful quarterly newsletter.
- Other Substack Amateur Radio newsletters recommended by Zero Retries.

These YouTube channels regularly feature Zero Retries Interesting content:

- [HB9BLA Wireless](#) by Andreas Spiess HB9BLA
- [KM6LYW Radio](#) by Craig Lamparter KM6LYW (home of the [DigiPi project](#))
- [Modern Ham](#) by Billy Penley KN4MKB
- [Tech Minds](#) by Matthew Miller M0DQW

These podcasts regularly feature Zero Retries Interesting content:

- [Store and Forward](#) - a podcast about the past and future of amateur radio, by Kay Savetz K6KJN (curator of the [Digital Library of Amateur Radio and Communications](#)) and Steve Stroh N8GNJ (Editor of Zero Retries).

- [Ham Radio Workbench](#) by George Zafiropoulos KJ6VU (and friends)
- [Foundations of Amateur Radio](#) by Onno Benschop VK6FLAB

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Email issues of Zero Retries are “instrumented” by [Substack](#) to gather basic statistics about opens, clicking links, etc.

More bits from Steve Stroh N8GNJ:

- [SuperPacket blog](#) — *Discussing new generations of Amateur Radio Data Communications - beyond Packet Radio (a precursor to Zero Retries)*
- [N8GNJ blog](#) — *Amateur Radio Station N8GNJ and the mad science experiments at N8GNJ Labs in Bellingham, Washington, USA*

Thanks for reading!

Steve Stroh N8GNJ / WRPS598 (He / Him / His)

These bits were handcrafted (by a mere human, not an Artificial Intelligence bot) in beautiful Bellingham ([The City of Subdued Excitement](#)), Washington, USA, and linked to the Internet via [Starlink Satellite Internet Access](#).

2024-12-13

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Footnotes for this Issue

To see the relevant sentence for the footnote, just click the footnote number.

[1](#)

Cross band repeaters are widely known in Amateur Radio, but to the best of my knowledge, only rarely used, at least in comparison that the vast majority of Amateur Radio repeaters are single-band.

[2](#)

Dual band VHF / UHF radios, by comparison, only became common decades after Amateur Radio VHF / UHF repeaters first became popular in the 1970s.

[3](#)

It's widely assumed that a duplexer is required in an environment like a mountaintop where the presence of many other transmitters and receivers can overwhelm a repeater. There are other forms of filtering such as isolators that may still be required with a SuperPeater located at such a site.

[4](#)

A duplexer and dual-band antenna is the minimum required for SuperPeater, but adding the third band for each provides additional flexibility at a minimum of increased cost.

[5](#)

There have always been repeaters that were located at individual Amateur Radio Operator's homes, especially those homes that are fortunate enough to be located in a good high location. But the difference is that a SuperPeater could (again, conceptually) be distilled down to a package that could reside on a residential balcony on a high rise building (obviously, operate at a safe, low transmit power level).

[6](#)

Expensive, but you only need one (or two, for a standby spare) for the SuperPeater. I'll guess that the first few SuperPeaters will be sufficiently compelling to receive an ARDC grant.

[7](#)

Though in a SuperPeater in a few years, it's feasible for all receivers on all VHF / UHF bands to be included in one ultra high performance radio. Today that's feasible with the [Ettus Research USRP X440](#) which has a bandwidth of 1.6 GHz... but the cost of such a capability is US\$27k at the moment. If that seems fanciful... remember that just a couple of decades ago, the Software Defined Radio technology we enjoy today at personal budgets was solely available to government agencies with very high budgets.

[8](#)

Dedicated channels for different modes may well turn out to be unnecessary if the receiver processing power / ka9q-radio is able to run multiple modems / decoders in parallel on each receiver channel. This is still very early, new, and conceptual.

[9](#)

I continue to hope that the US FCC will "finish" Docket 16-239 Part 2 and remove antiquated mode and bandwidth restrictions for data modes in US Amateur Radio VHF / UHF bands and thus legalize New Packet Radio's 1 Mbps full speed mode in the US.